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ABSTRACT

This paper discusses some theoretical aspects of contrastive phonetics. A fundamental problem in contrasting the sound structure of two languages is the question of equivalence between the two sound systems. There are four possible criteria: (1) similar spelling; (2) similar phonetic description and transcription; (3) use of phonological criteria; and (4) perceptual similarity. K. Wiik's phonetic contrasting and substitution tests involve an acoustic comparison of physical phones combined with a systematic approach to their phonological relationships, and can be used to detect interference between units which could hardly be equated on the basis of phonological structures. Because of differing learning strategies and the hierarchy of errors associated with interference, results of contrastive phonetics cannot be considered final. And finally, the relationship of contrastive phonetics to language teaching problems must be viewed in the light of the fact that, while contrastive phonetics involves a kind of error analysis, "errors" as such are not the object of study in this kind of analysis. Rather, it seeks to determine how native speakers react to various kinds of deviations from phonetic habits of their own. Therefore, the criteria used by language teachers to evaluate pronunciation are different from those used by contrastive phonetic analysis. (AM)

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CONTRASTIVE PHONETICS AND THE ANALYSIS OF SPEECH COMMUNICATION

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In this paper[1], an attempt will be made to discuss some theoretical aspects of contrastive phonetics. The only level of analysis which offers empirical evidence for equivalence between the speech sounds of two languages will be shown to be near the extreme end of the chain of linguistic communication, i.e. in the phonetic process of speech production and perception. Analysis on this level is here called contrastive phonetics. The procedure used for discovering equivalence is the application of perception or substitution tests but the test results are explained, and partly predicted, on the basis of an analysis of phonetic features or identification cues.

1

Contrastive analysis can be defined as a method of applied linguistics which is used to compare equivalent structures in the target language and the native language in order to predict and explain foreign language learning difficulties. This definition of contrastive analysis implies that negative transfer from the native language causes interference in the learning of equivalent structures in the foreign language. The discovery of equivalence and the arguments used in this process are therefore a crucial part of the contrastive analysis theory (see Valdman 1966:287-288; Bouton 1976; for further works on CA, see Sajavaara and Lehtonen (ed.) 1975).

The differences and similarities in the sound patterns of the mother tongue and the foreign language were discussed in a great number of works in the golden age of contrastive analysis. The most dramatic proofs of the existence of interference and negative transfer in foreign language learning came from the arsenal of phonological errors. With time, however, contrastive analysis of this kind was subjected to severe criticism for various reasons. The critics claimed, for instance, that the arguments which

[1] This is an extended version of a paper read at the Conference of Nordic Linguists at Hanasaari, Finland, on October 1-3, 1976, and published in the conference proceedings; see Karlsson (ed.) 1976.

were used to pick out two speech sounds of two different languages as equivalent were always material and extralinguistic and not structural and linguistic. The claim that traditional contrastive phonology involved a mere parallel listing of the structural patterns of two languages without any analysis was undoubtedly one of the most serious indictments against CA of this kind (for recent criticism, see James 1976).

The existence in speech performance of negative transfer from the native language cannot be disputed. The lower the level of phonetic competence in the foreign language, the closer the phonetic elements of speech are to the native language patterns; this concerns both rhythm, intonation, stress, timing of speech and qualities of individual speech sounds. On the level of the production and perception of concrete speech, the strongly criticised or often refuted claim of Weinreich's (1953:8) to the effect that "the greater the difference between the two systems, i.e. the more numerous the mutually exclusive forms and patterns in each, the greater is the learning problem and the potential area of influence" is quite acceptable (cf. Rusiecki 1976). At the initial stage of foreign language studies, the amount of incorrectness in the pronunciation of the student correlates positively with the amount of phonetic difference between the target language and the native language. The problem is what method of contrastive analysis should be applied for the prediction and explanation of this kind of interference. Can it be explained by means of the modern phonological theory, is it possible to abstract a new level of systematic contrast, the level of phonetic features, or is it necessary for us to resort to a *tertium comparationis*, which, in this case, could be the descriptional conventions of general phonetics? Thus, one of the fundamental questions is the problem of equivalence between the two sound patterns.

2

Superficially, the search for equivalent structures does not seem at all complicated; it can be carried out in the way it has been done in a number of studies contrasting the sound patterns of two languages: we simply take the sounds of the languages, describe their distribution, perhaps their feature-patterns or oppositions, and the phonetic qualities and compare the two descriptions. But what are the criteria upon which our equations are actually based? What are the arguments which enable us to say, for instance, that a given phoneme /x/ in one language and a given phoneme

/y/ in another language are equivalent or not equivalent? It is possible to abstract several principles from various works dealing with the sound patterns of two languages:

(1) cogency of similar letters in spelling;
(2) similarity of phonetic descriptions and of conventions of transcription;
(3) use of phonological criteria; and
(4) perceptual similarity.

What is the applicability of each one of these alternatives? Is any one of them acceptable as a basis for a contrastive analysis of the patterns of speech in two languages? Each of the above levels of comparison, the orthographic codes and the rules and patterns in the phonology of two languages, are sources of interference errors. It will appear that none of the alternatives is by itself sufficient as a descriptional level in contrasting the patterns of speech. The utility of contrasting the patterns of each one of the levels is discussed below.

(1) Graphemic similarity is sometimes used as an argument. Phonemes which are represented by one and the same letter in orthography are considered equivalent and, respectively, phonemes of the target language whose graphemic representations have no equivalents in the orthography of the native language are considered new and worthy of special training. The thinking behind ideas of this kind may often be naïve and the concepts of phoneme and letter often be confused in works of this sort but the basic problem involved, i.e. differences in orthographic codes as a source of pronunciation problems, is not at all naïve. Differences in the use of grapheme symbols and differences in spelling principles (eg. phonological vs. semi-morphological) are a source of errors which affect both the perception and the production of a foreign language. An analysis of the writing systems is, however, not a solution to the problem of equivalence (cf. Czochralski 1971:11-12; Erämetsä and Klemmt 1974; see especially pp. 28ff.).

(2) Another method which is used to prove the equivalence between elements in phonological systems is reference to traditional phonetic descriptions in accordance, for example, with the phonetic categories of IPA and the cardinal vowel diagram of Daniel Jones. In this method, speech sounds of the two languages which are found to be similar in their broad phonetic description are considered equivalent. The principle of 'pedagogical confrontation', in which sounds which are felt to be similar are contrasted, is not much different from this method of analysis. Traditional

phonetic description, which is applied implicitly in many works, has too many shortcomings to be accepted, shortcomings such as (a) dependence on categories predetermined by traditional classification, (b) ambiguity in the evaluation of the phonetic characteristics of the two languages (because normally the phonetic description is based on subjective impressions or literary tradition and not on empirical data acquired by means of experimental phonetics), and (c) attention to vague and immaterial physical characteristics of speech-sounds as brought up by the terminology of traditional phonetics (cf. Corder 1973:249).

(3) Phonological arguments may also be used to prove alleged equivalence, either in accordance with the traditional taxonomic concept of the phoneme or by making use of a phoneme description with distinctive (classificatory) features. The taxonomic concept of the phoneme does not seem to be a solution to the problem: phonemes are indivisible abstract categories which are in opposition to the other phonemes of the language. Since the reality of the phoneme exists only in such distinctive oppositions, the only way of finding equivalence on the phonemic level between two languages is to compare the entire patterns of phonological oppositions. The phonemes in the two systems which share similar oppositions respectively can be considered equivalent. The difference between a contrastive analysis in terms of traditional Prague phonology and one using distinctive features is only superficial. If distinctive feature analysis is applied, two segments sharing the same set of features are considered similar or equivalent (cf. Fisiak 1976). A natural condition for contrasting feature matrices is that both sound patterns are described by means of the same set of features (see Di Pietro 1971:135ff.). This condition may be extremely difficult to fulfil. Even if identical features are used in the description of the segments in each language, it is possible that segments with the same set of features are physically dissimilar and segments with dissimilar feature matrices are physically or perceptually more or less similar. But the core of the problem does not lie in the capacity of features to define accurate phonetic qualities but in the role of features in grammar and in linguistic communication. Three questions come up in connection with the concept of features: (1) Are features primarily articulatory or acoustic? (2) Should features be abstract or fairly concrete with respect to the articulatory and acoustic properties of the resulting sounds? (3) Are features real in the psychological or psycholinguistic sense?

In recent years there has been a tendency in phonology towards a more concrete level of description, which is similar to a general requirement of concreteness in linguistics. For phonology, concreteness means that postulated features and underlying phonological segments must be brought as close to the surface or phonetic reality as possible. Concretization of phonology does not seem to be, however, the right way to approach reality. Recent findings in experimental phonetics, psychology, and neurophysiology seem to push the features, phonemes and other phonological items further away from concrete speech towards the central processes of the production and perception of linguistic messages in the brain. Thus, features are neither articulatory nor acoustic but linguistic and, as such, also language specific to a certain degree. Therefore, the present theories of phonological features are as ineffective in predicting phonic interference as the classical theory of phoneme. It is possible, however, that some day there will be a set of phonological features which are really universal and also applicable to contrastive analysis.

(4) The remaining method of proving equivalence between the sound patterns of two languages is the use of contrastive phonetics. Distinctive feature analysis alone does not seem to be a convenient procedure for the discovery of phonological equivalence because it is too abstract and language-specific. In the search for arguments for equivalence between speech sounds in two languages we must go to the very outskirts of linguistic processing, to the mechanism which is used by the speaker to transform the linguistic information of the phonological segment string into the actual speech signal, and to the mechanism which is used by the listener to detect the corresponding phonological information.

3

Before discussing the special problems related to language contact in foreign language learning which are of interest for contrastive analysis, it is necessary to sketch, in broad outline, the processing of the speech chain from the perspective of modern phonetics. The role of articulatory movements in the transmission of information is that of converting the phonological information, i.e. the string of symbols of the phonologically coded message into sound waves. From the point of view of phonology, this conversion changes the chain of distinct phonological segments into a blend of various qualities and pretended or overlapping

boundaries between them. The reasons for the resulting variation cannot be analyzed here but it is worth noticing that any feature in phonetic variation, whether it is due to an intended articulatory gesture or some motor constraint, serves as a piece of information for the listener. The properties of the sound waves of speech which convey the information of phonological categories or which, in other words, are used in perception by the listener to detect a given category are called either phonetic features or acoustic cues of identification. Each phoneme or phonological feature of a language can be described, on the physical level of speech, as a set of cues or phonetic features which bring about the perception of the given phoneme in various contexts. In the light of recent findings in speech perception research, it seems plausible that there are special feature detectors tuned to reveal, in the sound wave, the acoustic features which are used as cues for phonological categories in speech. Evidence for feature detectors has been gathered in tests with, for instance, voice onset time and formant transitions. Moreover, the detectors seem to be tunable, which might explain their function in languages with phonetically different sound patterns (for experimental works on this topic, see Paap 1975; Wood 1975; Cutting 1976; Morse & al. 1976). From the point of view of a linguistical description, the patterns of phonetic features or cues of identification form an autonomous level of abstraction, a kind of 'third articulation', which is a phonetic counterpart to the phonological competence of the speaker.

For speakers of one and the same language the feature detector system is, of course, matched to the acoustic patterns which correspond to the habits of motor implementation of speech in their language. In foreign language learning we find interference between the cue patterns of the mother tongue and the target language. Suppose that a given segmental phonological category /x/ of the target language is phonetically implemented as phonetic features (or as phonetic cues from the point of view of the listener) C_1 C_2 C_3. Let us suppose that in the listener's mother tongue there is a phonological category /y/ which has one cue similar to one of the cues of the /x/ of the target language. In peception this results in category /x/ being associated with category /y/ of the mother tongue. In the process of speech sound perception this phenomenon also determines our impression of foreign speech-sounds: they may sound i-like, u-like, p-like, etc. according to unconscious associations with the phonological categories

of our own language. This categorization according to the familiar patterns of speech-sounds is, of course, in accordance with a general tendency to correlate new phenomena of sensation with existing perceptual categories. The application of perceptual associations or substitutions is one more level of reference to be used in a contrastive description of the sound patterns of two languages. Certain data seem to support this choice: when based on perceptual associations exposed by listening tests, the equations are mental and psychologically real and not simply arbitrary. Accordingly, the criteria are interlinguistic, perhaps not exactly linguistic, instead of being extralinguistic. Moreover, the criteria for equivalence in this case are formal and structural and not substantial in the way they are if decisions on equivalence are based on phonetic similarity only.

The patterns of phonetic features or cues can also be employed to explain or predict the interference which takes place in the opposite direction in interlanguage communication, i.e. in the student's pronunciation of the target language. The student who identifies category /x/ of

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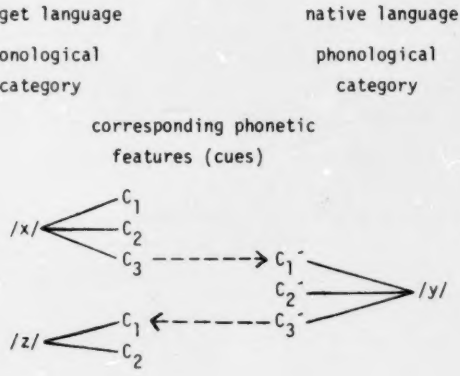
FIGURE 1. Interference of phonetic features



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the target language with category /y/ of his own language will accordingly

produce a sound which is close to the 'basic allophone' of the familiar category. This, again, may include cues which his interlocutor associates with category /z/ different from the original /x/. Thus, the bidirectional interference results in a 'phonemic error' in pronunciation. Figure 1 illustrates an idealized case of interference: the phonological errors in the use of categories /x/ and /z/ are explained by the fact that both have phonetic features which function as a cue for one and the same category /y/ in the native language of the student. Errors of this kind are found in the learning of both vowel and consonant systems of a foreign language.

The pioneer in the field of Finnish-English contrastive phonetics, Kalevi Wiik, applied the idea of phonetic contrasting and substitution tests in his work on Finnish and English vowels, which was published in 1965 simultaneously with the famous contrastive structure series. The idea of the acoustic comparison of physical phones combined with a systematical approach to their phonological relationships was, however, sketched as early as 1961, in two papers presented by Wiik at the Helsinki Congress of Phonetic Sciences and in a Finnish language teachers' yearbook. (For contrastive phonetic analyses of vowel systems, see also Kitzing 1972; for a CA of English and Finnish consonants, see Wiik 1966 and Suomi 1976).

Interference between units which could hardly be equated on the basis of phonological structures can also be detected by means of this method, eg. confusion in phonological segmentation, confusion between vowels and consonants, or confusion between segmental and suprasegmental phenomena. In addition to patterns of segmental phonemes or phonological features, the concept of identification cues also gives a useful perspective to the larger phonetic units of speech which seem to serve as cues for higher-level structuralization in perception and which seem to cause severe problems in the comprehension of a spoken foreign language.

In a contrastive analysis applied to the 'pronunciation' problems of a foreign language (including problems in both perception and production), perceptual substitutions are a natural criterion of equivalence. A speech-sound or a phonetic structure of the TL is considered to be 'equivalent' to that category of the NL with which it is associated in perception by the student. If we are aware of the perceptual substitutions and the psychoacoustic reasons for them (i.e. the interfering cue patterns), we also recognize some of the barriers which every language student must overcome during the learning process, barriers which are always present but which

are seldom revealed to the learner.

4

The method of contrastive phonetics whose principles and theoretical starting-points are outlined in this paper is not one of a mental or introspective type of linguistics. An analysis of this kind cannot be implemented by a scholar working in his study and using only grammars of the two languages as his material, because the object of the analysis is the actual language contact, i.e. the reactions of the speaker of one language to the native or foreign language stimuli produced by the speakers of the other. This implies an empirical analysis of the entire chain of speech communication employed by the speakers of both languages as well as an analysis of the interlanguage - from the perspective of both the sender and the receiver of the linguistic message. An integral part of the procedure of such an analysis is a kind of 'error analysis', i.e. tests which are used to find out how the student perceives, in terms of linguistic categories, the utterance of the native speaker and how the native speaker evaluates the utterances produced by the foreign language student. 'Pronunciation errors' as such are not, however, the objective of this testing and the results obtained are not considered 'errors' in the classroom sense of the word.

Unfortunately, the capacity of the tests available for us at present to reveal the 'critical' points in the interlanguage speech channel is rather limited, partly because we still lack an integrated picture of the mechanism functioning in the transfer of information in a normal language communication. There is no other way of testing speech perception available for contrastive analysis, except the identification tests based on minimal word pairs and other traditional methods of testing pronunciation. These methods are, however, so closely related to the taxonomic view of language that they are only suitable for the testing of certain types of phonological contrasts (for the methods of testing, see Moisio and Valento 1976). We can easily test the difficulties which a Finn meets with a given phonological contrast, eg. that of English *pick - pig - big*, by using isolated test-words, words in meaningful sentence-frames, and synthetic speech stimuli, while we have no relevant method for an empirical analysis of the differences in the signalling of higher-level linguistic units in speech or the differences in the patterns of phonetic cues in the speech signal

which are used to detect such units. Yet, phonology is not the only level of reference for concrete phenomena of speech. Variation in speech can also reflect (or signal) higher-level structures such as morphological and syntactic patterns, lexical units or even textual features such as topicalization of the utterance. For instance, the process of detection for a lexical word in English may be somehow different from Finnish as a consequence of linguistic differences of a type discussed by Fred Karlsson in the present volume, although it is not possible to verify this hypothesis by means of the methods available at present. When it becomes possible, however, we will have revealed an essential source of difficulty for a Finn in the comprehension of spoken English (cf. Ringbom 1976:3). This piece of information may also be of considerable importance in the attempt to find a way of teaching which helps learners to overcome difficulties due to this higher-level interference phenomenon of phonetic processing.

Contrastive phonetics, i.e. the search for interference in the patterns of the phonetic processing of the linguistic message, does not make contrast at the phonological level unnecessary, but it complements phonological analysis when an error is clearly due to phonological interference or when an error can be predicted on the basis of phonology alone. And such errors are not unusual in foreign language learning either, as shown in the classics of contrastive phonology. It is clearly obvious that the results of contrastive phonetics are never final: whenever some of the partial problems have been solved and certain research objectives have been reached, new targets and new problems are revealed. New information about language and speech communication also reveals new insights into contrastive problems, which will have to be integrated with the body of existing data. Therefore, it also seems justified that the partial results are applied in textbooks and teaching material instead of waiting for the 'final truth' (for an attempt in this direction, see Lehtonen & al. 1977).

As regards the capacity of phonetic CA to predict errors and difficulties in language learning, at least two factors must be taken into consideration: differences in foreign language learning strategy and the hierarchy of the errors associated with interference. Although it might be possible to make a list of potential errors, without any error-analysis type of testing, the value of such a list would be diminished by the fact that some of the difficulties predicted may be common to all learners but

some of them may be met by a certain number of the students only. Moreover, certain 'difficulties' predicted by the analysis do not turn up in practice at all or they are overcome at an early stage of language learning, while certain difficulties persist and are still present at the highest university level. Neither is the set of interference errors a stable pattern in which errors turn up like automata in correlation to the progress of learning while the rest of the learning pattern remains unchanged. The error and difficulty pattern is dynamic and changes constantly during the progress of studies. Certain errors may appear at a fairly high level as a consequence of the disappearance of some other errors or as a result of a new pattern of interference, which is caused when some subsystems of the target language are adopted in the transitional competence of the student.

5

One of the external factors affecting contrastive phonetic analysis as applied to the problems of language teaching is the definition of the objectives of the CA procedure. The crucial point is the definition of 'pronunciation error'. It is evident that errors in the production of a given phonological segment in speech, which do or do not cause an error in the perception of a given isolated word, i.e. 'phonological' and 'allophonic' errors, are one specific type of pronunciation errors only. The relative importance of these segmental errors in perception is not known as compared to errors, for instance, in timing of speech or errors in pausing, stressing, and dynamic patterning (including intonation) of speech. But it should also be pointed out that the 'active' errors produced by the learner are often just a reflection of a shortcoming in the processing of the foreign language message, including both the reception and the production as well as the linguistic interpretation of the speech signal.

Furthermore, the effect of various kinds of errors in the process of communication is not known. One of the questions to be answered by contrastive phonetics is how native speakers react to various kinds of deviations from phonetic habits of their own. From the communicative point of view a pronunciation error which has an irritating effect on the native speaker is worse than an error which is perceived as a feature of a foreign accent but which is socially acceptable. The situation is, however, complicated by the fact that the criteria used by language teachers for

evaluating pronunciation errors (as well as their ability to perceive them) is quite different from those used by native speakers.

REFERENCES

Bouton, L.F. 1976. The problem of equivalence in contrastive analysis, IRAL 14, 143-163.

Corder, S.P. 1973. *Introducing applied linguistics*. Harmondsworth: Penguin.

Cutting, J.E. 1976. Auditory and linguistic processes in speech perception: Inferences from six fusions in dichotic listening, *Psychological review* 83, 114-140.

Czochralski, J.A. 1971. Zur sprachlichen Interferenz, *Linguistics* 67, 5-25.

Diehl, R. 1976. Feature analyzers for the phonetic dimension *stop* vs. *continuant*, *Perception and psychophysics* 14, 267-272.

Di Pietro, R.J. 1971. *Language structures in contact*. Rowley, Mass.: Newbury House Publishers.

Eliasson, S. 1974. Contrastive analysis of phonological rules, *Reports from Uppsala university department of linguistics* 3, 28-34.

Erämetsä, E., and R. Klemmt 1974. *Grundlegung zu einer pädagogischen Phonetik des Deutschen auf kontrastiver Basis (Finnisch)*. Veröffentlichungen des Germanistischen Instituts 2. Universität Jyväskylä.

Fisiak, J. 1976. Generative phonological contrastive studies, *Kwartalnik neofilologiczny* 23, 119-124.

James, C. 1976. A review of Kontrastive Linguistik by E. Burgschmidt and D. Götz, IRAL 14, 203-206.

Karlsson, F. (ed.) 1976. *Papers from the third Scandinavian Conference of Linguistics*. Turku: Text Linguistics Research Group.

Kitzing, K. 1972. *Kontrastiv akustisk och perceptuell analys av vokalfonem hos nordtyska och sydsvenska gymnasister*. Lund: Liber.

Lehtonen, J., K. Sajavaara, and A. May 1977. *Spoken English: the perception and production of English on a Finnish-English contrastive basis*. Jyväskylä: Gummerus.

Moisio, R., and E. Valento 1976. *Testing Finnish schoolchildren's learning of English consonants*. Jyväskylä Contrastive Studies 3. Reports from the Department of English. Jyväskylä: Department of English.

Morse, P.A., J.E. Kass, and R. Turkienicz 1976. Selective adaptation of vowels, *Perception and psychophysics* 19, 137-143.

Paap, K.R. 1975. Theories of speech perception, *Understanding language*, ed. D.W. Massaro, N.Y., San Francisco, London: Academic Press, 151-204.

Ringbom, H. 1976. What differences are there between Finns and Swedish-speaking Finns learning English? H. Ringbom and R. Palmberg (ed.), *Errors made by Finns and Swedish-speaking Finns in the learning of English*. Engelska institutionens vid Abo Akademi publikationer 5. Abo, 1-13.

Rusiecki, J. 1976. The development of contrastive linguistics, *ISB-Utrecht* 1, 12-44.

Sajavaara, K., and J. Lehtonen (ed.) 1975. *A Select Bibliography of Contrastive Analysis*. Jyväskylä Contrastive Studies 1. Reports from the Department of English, University of Jyväskylä, 1. Jyväskylä: Department of English.

Suomi, K. 1976. *English voiceless and voiced stops as produced by native and Finnish speakers*. Jyväskylä Contrastive Studies 2. Reports from the Department of English 2. Jyväskylä: Department of English.

Valdman, A. (ed.) 1966. *Trends in Language Teaching*. New York.

Wiik, K. 1961. Suomen ja englannin vokaalien eroista. Suomen uusien kielten opettajien liiton (SUKOL) vuosikirja 2, 7-15.

Wiik, K. 1962. Phoneme boundaries of Finnish vowels. *Proceedings of the fourth international congress of phonetic sciences Helsinki 1961*. The Hague. 795-799.

Wiik, K. 1965. *Finnish and English vowels: a comparison with special reference to the learning problems met by native speakers of Finnish learning English*. Annales universitatis Turkuensis B:94. Turku: University of Turku.

Wiik, K. 1966. *Finnish and English laterals: a comparison with special reference to the learning problems met by native speakers of Finnish learning English*. Publications of the phonetics department of the University of Turku 1. Turku: Department of Phonetics.

Wood, Ch.C. 1975. Auditory and phonetic levels of processing in speech perception: neurophysiological and information-processing analyses, *Journal of experimental psychology* 104, 3-20.